Question 1 ................................................................. (10 points)

(a) [5 points] What is printed by the following program fragment?

```java
double degC, degF;
degC = 100; // at which water at sea level boils
degF = 9/5*degC + 32;
degC = degF-32 * 5/9; // hint: 32*5 = 160, 17*9 = 153
System.out.println("degC = "+degC);
System.out.println("degF = "+degF);
```

(b) [5 points] Show how you would fix this program so that it computes and prints the correct (expected) answers.

Question 2 ................................................................. (10 points)

(a) [5 points] What is printed by the following Java statements?

```java
int i = 4;
while (i>=0) {
    System.out.println(i%3);
    --i;
}
```

(b) [5 points] Rewrite (simplify) the code fragment above using a `for` loop.
Question 3 ...................................................... (15 points)

Complete the following Java methods.

(a) [5 points] Returns the average of three specified doubles.

```java
public static double average(double a, double b, double c) {
    // Implement the average method
}
```

(b) [5 points] Returns the smallest of four specified floats.

```java
public static float smallest(float a, float b, float c, float d) {
    // Implement the smallest method
}
```

(c) [5 points] Returns true if the quadratic equation \( a x^2 + b x + c = 0 \) has at least one real-valued solution \( x \); false, otherwise.

```java
public static boolean hasRealRoot(double a, double b, double c) {
    // Implement the hasRealRoot method
}
```
Question 4 ................................................................. (15 points)

(a) [10 points] Implement all methods for the following class:

/** A barrel is a cylinder with a height and radius. */
public class Barrel {

/** Constructs an empty barrel with specified height and radius. */
public Barrel(double h, double r) {

}

/** Returns the capacity of this barrel. (The capacity is
 * the volume of liquid in the barrel when it is full.) */
public double getCapacity() {

}

/** Returns the volume of liquid currently in this barrel. */
public double getCurrentVolume() {

}

/** Attempts to add the specified volume of liquid to this barrel.
 * Less than the specified volume of liquid will be added if the
 * barrel becomes full. Returns the actual volume added. */
public double addLiquid(double volume) {

}

} // declare private
// fields here
(b) [5 points] This part of the question is about using a class. Specifically, using the methods of the class Barrel defined above, implement the method main for the following class:

```java
/**
 * Demonstrates use of the class Barrel.
 * (1) Constructs a barrel with height 1 meter and radius 1/2 meter.
 * (2) Uses the constructed barrel to print its capacity.
 * (3) Adds 1 cubic meter of water to the barrel.
 * (4) Prints the actual volume of water added.
 */
public class BarrelDemo {
    public static void main(String[] args) {
```